Patent Application of
John D. Unsworth and Alan J. Humphreys

DEVICE AND METHOD TO ASSIST IN PUTTING ON TUBULAR GARMENTS OR COVERINGS, FOR EXAMPLE, SOCKS AND CONDOMS AND GOVES

FIELD OF THE INVENTION

This invention relates to a device and method to assist in the putting on tubular garments, or garments that include tubular elements, and more particularly socks, stockings, similar leg coverings, condoms, gloves, and pants.

INTRODUCTION AND SUMMARY OF THE INVENTION

The prior art with respect to devices to assist in the donning of socks and similar foot garments, is similar to methods to don condoms and gloves; both teach methods to don tubular garments or coverings. This invention teaches methods and devices that assist in the donning of all such tubular garments or coverings and is not limited to particular tubular devices. This invention also discloses devices in which the donning assistance is incorporated into the tubular garment or covering, rather than being separate from it.

Various designs of devices for putting on stockings are known and devised to help disabled persons suffering from various handicaps in their ability to move.

There exist staff-shaped devices which are provided with hoop or sleeve-like members of varying shape and which usually are made of metal or other stiff material. This type of device has a low friction coefficient and therefore a stocking easily slips off before it has reached the correct position.

There also exist devices which are made of soft material. These types of devices are not so common and the pull-on devices of this kind which now exist require great user mobility.

Numerous innovations for sock donning assist devices have been provided in the prior art that will be described. However, even though these innovations may be suitable for the specific individual purposes to which they address, they differ from the present invention in that they are separate form the tubular garment which is being donned.

For example, U.S. Pat. No. 4,066,194 to Leland teaches a sock donning device that includes a handle member from which laterally and transversely depend a pair of sock expanding and gripping members, and a combination frame positioner and sock release device.

Still another example, U.S. Pat. No. 4,260,083 to Aslin teaches a pull-on device for stockings that includes a stocking-foot resembling piece. The sole of the piece is stiff in the longitudinal direction and resilient at a middle portion. The middle portion is connected at the heel part with a rearward protruding plate member.

Yet another example, U.S. Pat. No. 4,284,216 to Leland teaches a sock donning assist device that includes a sock donning device that includes a handle member from which

laterally and transversely depend a pair of sock expanding and holding members, and a control bar that extends between the wire-like handle members so as to adjust the space there between.

Still yet another example, U.S. Pat. No. 4,516,704 to Hagman teaches a hosiery donning aid that includes a rigid hoop and a handle. The handle is telescopic and pivotally secured to the inside of the hoop.

Yet still another example, U.S. Pat. No. 4,638,932 to Keller teaches a donning aid that includes a tong-like member having a pair of elongated arms extending from a handle end to a gripping end. The arms are integrally joined at the handle end in a U-bend and extend substantially parallel in close side-by-side relationship to the gripping end. Resilient protective pads are provided at the gripping end of each arm.

Still yet another example, U.S. Pat. No. 4,789,087 to Doorenbos teaches a device for assisting in putting on elastic hosiery that includes an expandable tip consisting of a division in the portion over which the stocking is placed, means for biasing the two split parts to a normally closed position, and a latch to hold the device in an open position.

Yet still another example, U.S. Pat. No. 4,896,803 to Wilkens teaches an aid for putting on stockings that includes a frame-like construction with at least four substantially equidistantly spaced substantially parallel-extending support rods having first ends and second ends. The first ends are interconnected by means of a first clip and the second ends are interconnected by means of a second clip.

Still yet another example, U.S. Pat. No. 4,942,988 to Doorenbos teaches a device to aid in putting on elastic hose that includes two looped ends to be inserted into the stocking. The loops are hinged together and movable between a closed position and a spread position. The hinge includes a slide.

Yet still another example, U.S. Pat. No. 5,249,720 to White teaches a tool for applying support stockings that includes a tongue positioned between side rails which are connected to handles. The tongue includes an extension which is engaged by the handles to cause centering of the tongue between the side rails.

Still yet another example, U.S. Pat. No. 5,303,856 to Weatherholt, Sr. teaches a sock donning apparatus that includes a support post arranged to slidably mount a guide tube having a platform secured thereon. The platform includes a support arm with a generally U-shaped support plated that is oriented at an obtuse angle relative to the platform.

Yet still another example, U.S. Pat. No. 5,322,199 to White teaches an apparatus for assisting a person in putting on a stocking that includes an arcuate hollow form is releasibly attached to the upper edge of a stocking by clamp elements located at spaced points on the hollow form. Elongated straps extend from the clamping points.

Finally, an example of devices that assist in the donning of condoms is U.S. Pat. No. 4,840,187 to Brazier which includes a tubular device that holds the condom open and guides it over the penis.

It is apparent that all these dressing aids are separate devices from the tubular garment or covering. The purpose of this invention is to avoid having to use a device separate from the sock or condom to assist in the donning of the said tubular devices.

It is the purpose of the invention to incorporate the means for donning tubular garments or coverings, into the articles themselves, so that the user need not take a separate device with him to ensure that he is able to put these articles on.

It is also the purpose of this invention to make self donning tubular garments or coverings, unobtrusive.

The present invention has as its main feature the incorporation of springy elements that run approximately parallel to the longitudinal axis of a relatively flexible tubular element **1**, which can be made of any flexible material and which can be straight, as in the case of a condom or heel-less socks, or curved as in the case of socks with heels,.

The Purpose of the springy elements is to provide a motive force that acts to unroll a rolled-up tubular element and cause it to unroll or roll-back and cover the wearer's foot or other body part without further assistance of the wearer. The springy elements are loaded by the rolling-up of the tubular element. When the loaded springy elements are allowed to unload, they spring back, rolling back the rolled-up tubular element to which they are attached or of which they are a part.

It is important to note that the springy elements act in a direction that is parallel to the longitudinal axis of the tubular element **1**. This means that they can be used in combination with elastic socks, such as those used to prevent Deep Vein Thrombosis (DVT), that have elasticity principally in a direction at right angles to the longitudinal axis of the tubular element 1. This makes this invention applicable to the very type of sock that is so difficult to put on and off.

These springy elements can be attached to the exterior and or interior of the said tubular elements by various means well known to the art. This would include adhesives, or flexible pockets, similar to those that accommodate battens in sails. These pockets can be formed by attaching various layers of a multi-layered tubular element, or by separate flexible strips attached to the said tubular element. The means for attachment of the said layers or pockets can be effected by means well known to the art, which would include stitching, adhesives, cross-linking polymers by chemical or thermal means to name a few examples. The springy elements themselves can be made of any springy material, such as steel, or plastic. Some preferred embodiments use only enclosed elongated pockets or ribs formed or molded in the material from which the tubular element is made, or attached to it, or a combination of the two, and containing air or some other

suitable gas that can be at ambient pressure or some other pressure and that becomes or is further compressed in the loaded state and expands as it unloads and springs back. These balloon type springy elements are most suitable for condoms, but can of course be used for other tubular garments or covering elements. In a condom, these elongated pockets or rigs can be formed from the proximal end of the tubular element by adding fingers to the mold along side the tubular dip mold. These fingers will form pockets in the wall of the condom, with open proximal ends which, after inflating the pockets, can be then sealed by various methods well known to the art. The springy elements in the condoms can be located where they will have the least effect on sensitivity and can be straight or curved to enhance the sensory experience.

Other preferred embodiments incorporate the springy elements into the material from which the tubular element is formed. An example of these preferred embodiments is a sock that is woven from springy wires that are interwoven with the threads or other elements that form the sock, and run in an approximately parallel direction with the longitudinal axis of the tubular element. These wires, like the other springy elements of other preferred embodiment, can be made of various materials such as steel, plastic or gas ribs or tube. They may also be made from superlastic materials such as nickel-titanium. The springy elements can be of various cross-sections, including round and rectangular.

Some preferred embodiments include springy elements that are made of Shape Memory Alloy (SMA) or other memory materials that exhibit shape recovery. These springy elements can be attached to or form a part of the tubular element or both. These materials have the advantage of unloading, or recovering a memorized shape, in response to temperature change, which can be supplied by the heat of the foot, or heat applied by separate means such as a bath, a hair dryer or be effected by resistive electrical heating of the SMA springy element, which exhibits good resistive electrical properties. For example, using these materials the tubular element can be rolled-up to load the "springy element" while in the martensitic state, which is relatively unspringy

or floppy. It can then be unloaded by heating it above the Austenitic start temperature and to fully unload them at the austenitic finish temperature. This unloading causes the SMA or other similar material to recover the shape that has been previously imparted into it, usually at very high temperature, which in this case would be approximately straight, with perhaps a slight curve for the heal. This recovered shape acts to unroll the rolled sock over the wear's foot and thus put itself on the wearer's foot. The heating necessary to cause this martensite to austenite transformation and thus the recovery of the imparted shape, can be supplied by the elevated temperature of the wearer's foot, or by some external temperature source, such as a hair blower or by electrically heating (resistive) the SMA material that comprises the springy element. Once the sock is on the wearer's foot, the springy element can return by cooling to it martensitic form and the sock will remain on the wear's foot. Removal of the sock can be then effected by normal means, assisted by a hook or loop attached to the top or near the top of the sock cuff.

Other preferred embodiments incorporate both conventional springy materials, for example, steel, plastic or superlastic material which would be loaded up by rolling-up **4** the tubular elements **1**; in combination with unconventional springy materials such as Shape Memory Alloy (SMA) or other materials exhibiting shape recovery properties, that unload in the opposite direction. For example the conventional springy materials attached to or incorporated with the sock would be loaded by rolling-up the sock to form a closed end torus. This conventional springy material would act when unrestrained, to completely unroll the sock, as when it is normally worn on the foot. If the toes of the wearer were placed in the open end of the torus, when unloaded, the sock would roll-back onto the wearer's foot and the sock would thus put itself on the wearer. The SMA or similar material, forming the other springy material in the sock would have a shape imparted to it, usually at high temperature, which would have the shape of approximately that which would conform to the shape of the rolled-up sock. However, at ambient temperature the material would be in its martensitic state and relatively floppy, and would not significantly restrain the unloading of the conventional springy

material while the sock is unrolling to its fully extended wearable form. However when the SMA or similar material is heated, it would recover its coiled or rolled-up, memorized shape, which could be set strong enough to overcome the oppositely acting conventional springy element. The springy element made of the SMA or other similar material would then cause the sock to roll-up and off the wearer's foot. The rolled-up sock can then be temporarily constrained, by means described bellow, to maintain its torus like shape, even after the SMA returns, by cooling, to its floppy martensitic form, at which point the conventional springy material prevails, acting to otherwise un-roll the sock in the opposite direction, but for the temporarily imposed constraint. As mentioned the heating of the SMA or other similar material, could be effected by a number of different means, including a warm water bath or electrical resistive heating. This resistive heating can be effected by a battery and controller **2b** attached to the sock **8,** with power delivered to the springy elements **2a** by conductors **2c,** all as illustrated in Fig. 6. The power supplied by it to the SMA material can be turned on and off by a switch **2d** actuated by the wearers other foot or by pressing it against another object or by remote control means or other means well known to the art. This arrangement might of course be reversed so that the convention springy material would act to roll out the socks and the SMA or other similar material would act in the opposite direction to roll-back the socks.

Some preferred embodiments can contain springy elements of various types in combination.

The preferred embodiments include restraining means to temporarily restrain the sock, gloves or covering element to maintain its approximately torus shape when the attached or incorporated springy elements are in their loaded mode, which would otherwise cause the sock to unroll. These restraining means are typically comprised of one or more detachable attachments, of any suitable area, such as complementary patches of hooks and loops, such as Velcro, or adhesives but of course could be effected by any of the many detachable attachments that are well known to the art. These restraints may in

certain preferred embodiments be unlatched, released or separated by the wearer exerting a pushing motion into the distal end of the enclosed torus with his foot or other body part, in some cases, the torus itself being constrained by its contact with the ground, which is perhaps enhanced with a relatively high friction skid patch, such as rubber attached to the rolled-up tubular element at that point of contact. Once this detachable attachment is removed, the rolled-up tubular element will unroll, powered by the connected unloading springy elements. In other preferred embodiments the restraining means may be comprised of or include a package, in which the tubular element is rolled-up, such as a condom, that has a tear-away end, that when torn-away, releases the springy element to unload and unroll the rolled-up tubular element over the abutting penis.

Some preferred embodiments include a ring that holds-open the tubular element at a minimum diameter so the wearer can place the distal end of the foot, hand or other body part into the orifice of the tubular element, while it is rolled-up into its approximate torus shape; but allow for radial enlargement of the tubular element to accommodate larger parts of the body, over which the rolled-up tubular element unrolls. In those cases where the tubular element is radially elastic, this ring also allows the tubular element to assume a diameter less than the said minimum ring diameter when that part of the tubular element has been rolled-off of the ring. In the case of elastic stockings, or other elastic coverings, the ring also reduces the collective inward radial compression of the sock or other covering against the body part where the sock is rolled-up, when it is rolled-on to the body part, making the donning more comfortable.

This ring can be made of a coiled tension spring, formed by attaching both ends together and having its coil turns pulled together when at rest and while assuming its minimum diameter. The spring and hence the ring can be enlarged beyond its minimum diameter by the force of a body part entering the orifice of the ring, that has a diameter larger than that of the ring at its minimum diameter, causing the turns of the spring to separate. The ring can also be made like a bracelet, with an elastic element connecting a series of

beads or separate sliding and connecting elements attaching the beads. The beads, acting like the turns of the said tension spring, impose a minimum diameter of the ring, when they butt together, but allow the ring to expand beyond the minimum diameter. The ring, of whatever composition, can be attached to or form part of the cuff, at the proximal end or close to the proximal end of the tubular element.

DESCRIPTION OF THE DRAWINGS

These and other features, aspects and advantages of the present invention will become better understood with reference to the following description, appended claims and accompanying drawings where:

Fig. 1 is a perspective view of a tubular garment or covering with an enclosed proximal end, and an open distal end, incorporating springy elements.

Fig. 2 is a cross-sectional, perspective view of the same tubular garment or covering, illustrated in Fig. 1, partly rolled-up from its proximal end to its distal end

Fig. 3 is a cross-sectional, perspective view of the same tubular garment or covering, illustrated in Fig. 1 and Fig. 2, which has been fully rolled-up to form a closed-center torus and also a penis entering the inside distal end of the rolled-up tubular element.

Fig. 4 is a cross-sectional, perspective view of the lower section detail of the same tubular garment or covering, illustrated in Fig. 3.

Fig. 5 is a cross-sectional, perspective view of a tubular garment or covering, in this case a sock in its latched mode, about to be released by the forward kicking action of the foot into the inside distal end of the rolled-up tubular sock.

Fig. 6 is a cross-sectional perspective view of a sock that includes springy elements at the top and bottom of the sock and means for resistive heating of the springy elements to

recover memorized shapes imparted into Shape Memory Alloys (SMA's) or similar materials that exhibit shape recovery by similar means.

Fig. 7 is a perspective view of a fully deployed sock.

Fig. 8 is a cross-sectional perspective view of a partly rolled-up tubular garment or covering that has attached to it, or incorporated into it a ring **10** that holds the tubular section open to a predetermined minimum diameter to facilitate the deployment of the said tubular garment or covering over the foot or other body part.

Fig. 9a and 9b are perspective views of a ring **10** which is comprised of a connecting element **10b**, which may be elastic, which runs through beads or solid elements **10a** and forms a ring that has a minimum diameter, but can be stretched outwardly to form a ring having a greater diameter.

Fig. 10 is a perspective view of the fully deployed sock, including the ring **10**, in this case expanded by the size of the wearer's calf to a diameter greater than its minimum diameter.

Fig. 11 is a cross-sectional perspective view of the tubular garment or covering that is latched by a single element that is permanently attached to the distal outside end of the tubular element **1** and detachably attached at **5a** and **5b,** to the rolled-up portions **4** of the tubular element **1**.

Fig. 12 is a cross-sectional perspective view of a preferred embodiment of the invention which is a glove 11, the sleeve of which rolls-up and unrolls to approximately the base of the fingers of the hand.

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 1 illustrates two springy elements **2** connected to a tubular element **1** having a closed distal end and an open proximal end. Preferred embodiments of this invention also can have open distal ends and distal ends that can be opened and closed, which are often used in medical settings where access to the toes is required. Other example of open ended tubular elements **1** would be pant legs and shirt sleeves that are attached at their distal ends to the trunk of the pants and the trunk of shirts or coats. Another example of variations of tubular elements **1** is the sleeve and/or cuff of gloves 11, Fig. 12. However, most preferred embodiments have closed distal ends, and some such as condoms, require it. The tubular element **1** is illustrated as a straight tube, but it is to be understood that the tubular element can be any shape and come within the ambit of this invention. Socks **8**, for example can be curved to accommodate the wearer's heal, or be straight as in heal-less socks. Both come within the ambit of this invention.

The method: to make the tubular element **1** autonomously and easily cover a body part, it must be first rolled-up to form a torus like shape, as illustrated in Fig. 3, by turning the proximal ends of the tubular element 1 in direction **3** as illustrated on Fig. 1 and 2. This can be done by the wearer or by a care-giver in advance of their use. Alternatively this can be done by thermal control of Shape Memory Alloys (SMA's) or similar materials, forming all or some of the springy elements **2** as described above. For one use items, such as a condom, the tubular element may come roll-up and preloaded, ready to be released, when placed over the end of the penis.

For most preferred embodiments, this rolling-up of the tubular element **1** also loads the connected springy element **2**, such that when the rolled-up or partly roll-up tubular element **1** is released, it unloads by springing back, unrolling the tubular element **1**. It should be noted that in some preferred embodiments, even when the tubular element **1** is fully unwound onto the wearer's foot or other body part, the springy element may be designed to not fully unload; this is done in order to provide sufficient force for a

complete unwinding of the tubular device **1**. In such cases the springy element has been preloaded, prior to being rolled.

While Fig. 1 illustrates only two springy elements **2**, it is to be understood that any number of springy elements may be utilized. The location as well as the number and composition of these springy elements **2** will vary depending upon the circumstances, but generally these will be located with their longitudinal axes approximately parallel to the longitudinal axes of the tubular element **1** to which they attach or into which they are incorporated. However, the springy element **2**, for some preferred embodiments of the invention might include a helical spring element or several interleaved, or opposite handed helical spring elements, that coils helically around the tubular element such that the longitudinal axis of the gross coil is parallel with the longitudinal axis of the tubular element **1**, even thought the turns of the coil, are between normal and parallel to the longitudinal axis of the tubular element **1**.

Once the tubular element **1** has been loaded by rolling-up, in most cases it is convenient to restrain it so that it doesn't immediately unroll. Fig. 3, 4 and 11 illustrate means **5a, 5b** for restraining the unrolling of the rolled-up tubular element. These may take any convenient form, well known to the art, such as complementary hook and loop patches, snaps and similar detachable attachments **5a, 5b** which prevent spring back in direction **3c**. The location of these will vary, but will in general hold together facing turns of the coil **4** formed by the rolling-up of the tubular element **1**. While the illustrations show separate patches **5a, 5b** for these points of connections, for some preferred embodiments, only one connecting point may be used and the connecting point or points may be radially continuous, forming a circle running normal to the longitudinal axis of the tubular element. Other preferred embodiments may have restraints **5a, 5b** that run approximately parallel to the longitudinal axis of the tubular element **1**. The strength of the attachment may vary from point to point. For example, in the case of the detachable attachments that run parallel to the longitudinal axis of the tubular element, the attachment force, may initially be relatively high, to constrain the rolled-up tubular

element from unrolling, but the more proximate portions may have relatively low attachment force, to that the attachment acts like a zipper, allowing detachment in response to the unloading springing element, but sufficient attachment so that the rolled-up tubular element does not simply expand radially immediately upon initial detatchment, without unwinding. Points of attachment can also be effected with the use of releasable adhesives. Condoms, for example might have releasable adhesives located at locations of contact between contacting surfaces of the coiled **4** tubular element **1** to restrain the coils **4** from unwinding, but release as soon as the wearer pulls the turns of the coil **4** in direction **3b** with sufficient force, while his body part to be covered, in this illustration a penis, is pressed against the internal distal end of the tubular element **1** in direction **3d**, as illustrated in Fig. 3. Once released, the coiled tubular element **1** is free to unwind and cover the body part, without further intervention by the wearer.

The method by which the restrains **5a**, **5b** are released will vary depending upon the circumstances, but in one preferred embodiment of the invention, illustrated on Fig. 4, and 5 the foot **8** to be covered, may push against the interior distal end of the tubular element **1** in direction **3d**, while at the same time a skid patch **6** attached to the sock, contacts the ground **7**, and by maintaining a relatively stationary contact with the ground, causes a relative radial motion **3b** that is transmitted by the coiled tubular element **4**, causing the restraining patches **5a**, **5b** to move in directions **3c**, and causing them to separate. Once **5a**, **5b** separate, the springy elements **2**, not shown on Fig. 3, 4 and 5 for diagrammatical clarity, but which are attached to or form a part of the coiled **4** tubular element, spring back, cause the coil to unwind. When the coil **4** unwinds, it rolls up the foot **8** in direction **3e**, covering the foot, without further intervention by the wearer. Skid patch **6** can be a single patch or a radial band encircling the tubular element **1**, depending upon the circumstances.

Fig. 6 illustrates one possible way in which the springy elements **2a** may be attached to the sock, but other preferred embodiments of the invention may have any number of elements, located in different orientations, depending upon various factors, including the

fabric chosen and the shape of the wearer's foot. Fig. 6 also illustrates means for resistively heating Shape Memory Alloy (SMA) springy elements to recover memorized shapes, using a portable controller **2d**, battery **2b** to supply the power, and conductors **2c** to deliver the electrical energy to opposite ends of the SMA springy elements, to be resistively heated.

Fig. 7 illustrates possible locations of the restraining patches **5a** and **5b** and the skid patch **6**, although, as mentioned the location, size, shape and number of these will vary for each preferred embodiment, depending upon factors such as material type and use to which the device is put. In the case of a condom, a skid patch **6** would in most cases be unnecessary and the restraint **5a** and **5b** would in some preferred embodiments take the form of detachable adhesive. Fig. 7 also illustrates a loop **9** attached to top or cuff of the sock **8**. This is included in some preferred embodiments to assist in the removal of the sock. This can be quite large to allow a toe from the other foot to pass within the loop **9** to push the sock off. While a loop is illustrated, other preferred embodiments have hooks and other means to assist in removing the socks.

Fig. 8, 9a, 9b, and 10 illustrate the ring device **10**, described above to hold open the tubular element **1**, so as to permit the entry of the initial part of the body part to be covered by the said tubular element **1**. As mentioned above, this ring **10** can take the form of a spring, or bracelet. In the case of a bracelet type ring **10**, it can be comprised of beads **10a** and a continuous and preferably elastic connecting element **10b**. Instead of a continuous connecting element **10b**, some preferred embodiments utilize separate connecting elements that directly connect adjoining beads **10a** through their lumens. Fig. **9a** illustrates how this preferred embodiment maintains a minimum diameter, when the beads **10a** butt together. This minimum diameter is set so as to permit the entry of the appropriate body part into the orifice of the torus or coil **4** of the tubular element **1**, to initiate the rolling on of the sock **1a** or other covering tubular element **1**. Fig 10 illustrates how the ring **10** can expand to accommodate the size of a larger part of the covered body part and maintain comfort. Fig. 10 also illustrates how the elastic property

of the tubular element **1** for some preferred embodiments of the invention, allows the distal portion of the sock **1a**, adjacent to the toes, to contract radially to a smaller diameter than the minimum diameter of the ring **10**, once that portion of the said tubular element **1** has rolled off the ring **10**. Thus the minimum radius of the ring **10**, does not by itself, impose a minimum diameter on the covering tubular element **1,** except immediately adjacent to it, or that portion rolled around it. The location of the ring **10** with respect to the tubular element can vary. It **10** can be at the proximal edge or cuff of the tubular element **1**, as illustrated in Fig. 8, but can be closer to the distal end of the tubular element **1,** depending upon the circumstances. In some preferred embodiments, the elastic connecting element **10b** of the ring **10,** can be part of the tubular element **1**, and the beads **10a** may simply be connected, attached or incorporated into the elastic material from which the tubular element **1** is constructed. This arrangement is particularly suitable for condoms, where such beads may also increase stimulation. It is to be understood that beads are not limited to those having lumens, but those without as well. The ring(s) can be used for all tubular elements: gloves, socks, pants as well.

While Fig. 8 and 10 illustrate a single ring **10**, some preferred embodiments might include any number of rings, at various locations along the tubular element **1**.

Fig. 12 illustrates a preferred embodiment of the invention in the form of a glove **11** in which the sleeve and cuff roll-up and unroll to approximately the base of the fingers, easing there donning and taking off. The springy element(s) are not shown on Fig. **12**, for diagrammatical clarity, but springy elements are either attached or incorporated in the cuff and/or sleeve in appropriate locations, dimensions and numbers, to effect the purpose as described above for rolling-up and unrolling the tubular element 1. This preferred embodiment of the invention is especially helpful for the donning and taking off of surgical and rubber gloves.

While in the present invention, reference is made to socks, gloves, pants and condoms, it should be understood that these are only examples of a much larger class of tubular

elements which are the subject matter of this invention. It should also be understood that examples of particular covering devices, such as sock, should apply in most cases to condoms, and other tubular articles of covering, and visa versa. It should also be understood that many objects include tubular elements, whether open or closed at either or both ends, such as gloves and pants, and this invention applies to these tubular parts, and should be considered preferred embodiments of this invention.

While the present invention describes various preferred embodiments having certain specific features, it is to be understood that any preferred embodiment may have any combination, set or subset of features described in other preferred embodiments herein described.

While the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the inventions and appended claims.